

IN THE CLAIMS

What is claimed is:

- 1 1. A method of forming a microelectronic structure comprising:
2 forming a first thickness of an epitaxial germanium layer on a
3 sacrificial silicon layer;
4 removing a predetermined amount of the epitaxial germanium layer to
5 form a second thickness of the epitaxial germanium layer;
6 activating the epitaxial germanium layer and an oxide layer disposed
7 on a silicon substrate in an oxygen plasma; and
8 bonding the epitaxial germanium layer to the oxide layer.

- 1 2. The method of claim 1 wherein bonding the epitaxial germanium layer
2 to an oxide layer disposed on a silicon substrate comprises forming a
3 germanium oxide interface between the epitaxial germanium layer and the
4 oxide layer.

- 1 3. The method of claim 1 wherein forming the first thickness of the
2 epitaxial germanium layer on the sacrificial silicon layer comprises forming a
3 graded buffer layer on a sacrificial silicon layer and then forming a first
4 thickness of the germanium layer on the graded buffer layer.

1 4. The method of claim 1 wherein removing a predetermined amount of
2 the first thickness of the epitaxial germanium layer to form a second
3 thickness of the epitaxial germanium layer comprises polishing a
4 predetermined amount of the first thickness of the epitaxial germanium layer
5 by chemical mechanical polishing to form a second thickness of the epitaxial
6 germanium layer.

1 5. The method of claim 4 wherein polishing a predetermined amount of
2 the first thickness of the epitaxial germanium layer by chemical mechanical
3 polishing to form a second thickness of the epitaxial silicon germanium layer
4 comprises polishing a predetermined amount of the first thickness of the
5 epitaxial germanium layer by chemical mechanical polishing to form a
6 surface roughness in a second thickness of the epitaxial germanium layer of
7 about 5 angstroms or less.

1 6. The method of claim 1 wherein bonding the epitaxial germanium layer
2 to the dielectric layer comprises bonding the epitaxial germanium layer to the
3 oxide layer to form a composite substrate.

1 7. The method of claim 1 wherein activating the epitaxial germanium
2 layer and an oxide layer disposed on a silicon substrate in an oxygen plasma
3 comprises activating the epitaxial germanium layer and an oxide layer

4 disposed on a silicon substrate, wherein the oxide layer is about 1,000
5 angstroms in thickness, in an oxygen plasma.

1 8. The method of claim 1 wherein removing a predetermined amount of
2 the first thickness of the epitaxial germanium layer to form a second
3 thickness of the epitaxial germanium layer comprises removing a
4 predetermined amount of the first thickness of the epitaxial germanium layer
5 at a rate of less than about 10 angstroms per minute to form a second
6 thickness of the epitaxial germanium layer.

1 9. A method of forming a microelectronic structure comprising:
2 forming an epitaxial germanium layer on a sacrificial silicon layer;
3 activating the epitaxial germanium layer and an oxide layer disposed
4 on a silicon substrate;
5 bonding the epitaxial germanium layer to the oxide layer; and
6 removing the sacrificial silicon layer from the epitaxial germanium
7 layer.

1 10. The method of claim 9 wherein forming an epitaxial germanium layer
2 on a sacrificial silicon layer comprises:
3 forming a buffer layer on the sacrificial silicon layer;
4 forming an epitaxial germanium layer on the buffer layer; and

5 removing a predetermined thickness of the epitaxial germanium layer
6 to achieve a targeted epitaxial germanium layer thickness.

1 11. The method of claim 9 wherein activating the epitaxial germanium
2 layer and an oxide layer disposed on a silicon substrate comprises exposing
3 the epitaxial germanium layer and the oxide layer to an oxygen plasma.

1 12. The method of claim 9 wherein bonding the epitaxial germanium
2 layer to the dielectric layer comprises:
3 bonding the epitaxial germanium layer to the oxide layer; and
4 annealing the oxide layer and the dielectric layer.

1 13. The method of claim 12 wherein bonding the epitaxial germanium
2 layer to the oxide layer comprises bonding the epitaxial germanium layer to
3 the oxide layer and annealing the epitaxial germanium layer and the oxide
4 layer at a temperature between about 200 degrees Celsius to about 500
5 degrees Celsius for about 10 hours to about 50 hours.

6
7 14. The method of claim 9 wherein removing the sacrificial silicon layer
8 from the epitaxial germanium layer comprises:
9 grinding a portion of the sacrificial silicon layer to a predetermined
10 thickness; and

11 selectively etching the remaining portion of the sacrificial silicon layer.

1 15. A method of forming a germanium on insulator structure comprising:
2 forming an epitaxial germanium layer on a sacrificial silicon
3 layer;
4 removing a predetermined thickness of the germanium layer to
5 achieve a target thickness of the germanium layer;
6 activating the epitaxial germanium layer and an oxide layer
7 disposed on a silicon substrate with an oxygen plasma;
8 bonding the oxide layer to the epitaxial germanium layer to
9 form a composite substrate;
10 annealing the composite substrate;
11 removing the sacrificial silicon layer from the epitaxial
12 germanium layer of the composite substrate.

1 16. The method of claim 15 wherein removing the sacrificial silicon layer
2 form the epitaxial germanium layer comprises:
3 grinding the sacrificial silicon layer to a predetermined thickness;
4 selectively etching the remaining sacrificial silicon layer from the
5 epitaxial germanium layer.

1 17. The method of claim 15 wherein forming an epitaxial germanium layer

2 on a sacrificial silicon layer comprises:

3 forming a buffer layer on the sacrificial silicon layer; and

4 forming an epitaxial germanium layer on the buffer layer.

5 18. The method of claim 15 wherein removing a predetermined thickness
6 of the germanium layer comprises polishing a predetermined thickness of
7 the epitaxial germanium layer by chemical mechanical polishing at a rate of
8 less than about 50 angstroms per minute.

1 19. The method of claim 15 wherein bonding the oxide layer to the
2 epitaxial germanium layer to form a composite substrate comprises bonding
3 the oxide layer to the epitaxial germanium layer to form a composite
4 substrate comprising:

5 the sacrificial silicon layer disposed on the epitaxial germanium layer;

6 the epitaxial germanium layer disposed on the oxide layer; and

7 the oxide layer disposed on the silicon substrate.

8 20. A germanium on insulator structure comprising:

9 an epitaxial germanium layer comprising a diameter equal to or

10 larger than about 300 mm disposed on an oxide layer that is disposed on a

11 silicon substrate, wherein the silicon substrate is about 300 mm in diameter.

1 21. The structure of claim 20 further comprising a germanium oxide
2 interface between the epitaxial germanium layer and the oxide layer that is
3 less than about 100 angstroms in thickness.

1 22. The structure of claim 20 wherein the oxide layer is about 1,000
2 angstroms thick.

1 23. The structure of claim 20 wherein the epitaxial germanium layer is
2 about 1,500 angstroms thick.

5

10